

ARTICLE V.

CORTICAL LESIONS OF THE BRAIN. A COLLECTION AND ANALYSIS OF THE AMERICAN CASES OF LOCALIZED CEREBRAL DISEASE. By M. ALLEN STARR, A.M., M.D., Attending Physician, New York Dispensary; Assistant in New York Polyclinic, Department of Nervous Diseases.

THE localization of brain functions has been raised from the level of an hypothesis to that of a definitely ascertained fact within the past ten years. Meynert was the first to discard the doctrine of Flourens, that the brain acted as a whole, and on anatomical grounds declared that different portions possessed different powers. The study of aphasia led French observers independently to the same result. Fritsch and Hitzig in Germany, and Ferrier in England, arrived at a similar conclusion soon after by means of their well-known physiological experiments upon animals, and the results reached by them have been confirmed in a most striking manner by Munk, Dalton, and others. But while anatomical study, demonstrating a connection between various organs of the body and definite regions of the surface of the brain, may furnish grounds for *à priori* reasoning as to the function of those regions; and while physiological experiments upon animals may afford valuable suggestions as to the probable effect of limited brain disease in man, an accurate determination of the question of localization can only be reached by a study of clinical cases. The appreciation of this fact has led Charcot, Ferrier, Nothnagel, Exner, Wernicke, and others to collect the cases on record in which a limited area of disease, whose position was determined by a careful autopsy, had given rise to definite symptoms.¹ From the comparison and classification of these cases, certain general conclusions have been reached, and it is now possible to refer many symptoms occurring in the course of brain disease to a destruction of a definite area of the surface.

A generalization, in order to be reliable, must rest upon the analysis of a large number of facts. The collection of these facts is the first step in the progress toward such generalization. In the collection of cases of brain disease, the foreign observers have not had access to the records published in this country. But the number of cases which have appeared

¹ Charcot, *Localisation des Maladies Cérébrales*, Le Progrès Médical, 1875. Ditto, *Revue de Médecine*, 1877. Ferrier, *Localization of Brain Disease*, London, 1878. Charcot et Pitres, *Localisation des Maladies Cérébrales*, *Revue de Méd.* 1879. Boyer, *Recherches Cliniques sur les Maladies Cérébrales*, Paris, 1879. Nothnagel, *Topische Diagnostik der Gehirnkrankheiten*, Berlin, 1879. Exner, *Untersuchungen über die Localization der Function in der Grosshirnrinde*, Wien, 1881. Wernicke, *Lehrbuch der Gehirnkrankheiten*, Bd. II., III., 1882, 1883. Benedikt, *Localization der Function der Grosshirnrinde*, Wiener Klinik, 1883. Charcot et Pitres, *Localisation des Maladies Cérébrales*, *Revue de Méd.* 1883. Petrina, *Vrtljschr. für prakt. Heilk.* 1879. Petrina, *Ztsch. für Heilk.* 1881-1883. Vetter, *Deut. Arch. f. klin. Med.* 1883, 3 und 4.

in American journals is not inconsiderable, and, when gathered and classified, they form an important addition to the data of localization. They not only confirm and strengthen the results reached abroad, but they furnish facts for new and important conclusions.

The cases here brought together are all cases of disease of the cortex of the brain. It is in the cortex that conscious mental activity goes on, and hence it is in the cortex that mental processes are to be localized. Disease of the nerve tracts, to and from the cortex, or of the ganglionic masses interspersed along those tracts, while offering an interesting field for observation, has, by general consent, been excluded from the study of localization, and belongs to another division of cerebral pathology.

In a review of the American medical literature of the past twenty-five years, nearly five hundred cases of local disease of the brain have been found. Some of these cases are of great value. Many of them are too defective, either in the record of symptoms, or in the description of the situation of the lesion, to be of any service. For, as Nothnagel has clearly shown,¹ those cases only are of use in determining the function of limited areas of the cortex in which there was a single lesion of small extent, accurately located, and of considerable duration. If the lesions are multiple, it is impossible to connect definite symptoms with each. If the lesion is of large extent, the functions of two or more areas involved cannot be distinguished. If the patient dies soon after the invasion of the disease, especially if the disease be a cerebral hemorrhage, it is impossible to separate the temporary symptoms due to shock from the permanent symptoms due to the destruction of brain-tissue. The acceptance of these conditions has excluded many interesting cases, but has enhanced the value of the results obtained from the study of those which are cited.

Cases of brain disease afford two distinct kinds of information regarding the function of the cortical areas, which may be termed positive and negative, and each is of value.² The positive evidence consists of the morbid symptoms produced by the lesion in a definite area. The negative evidence consists of the normal functions remaining when that area is diseased. For example: a lesion limited to the paracentral lobule of one side produces paralysis of the opposite leg, but does not affect the powers of speech, of hearing, or of vision. We are warranted, therefore, in concluding positively, that the motor centres for the leg lie in this area, and, negatively, that the functions of speech, hearing, and vision do not lie in this area. In the analysis of the cases here cited, both of these lines of evidence will be followed.

There are certain symptoms which are common to various kinds of disease of the brain in whatever region they are located. Such are headache, vertigo, digestive disturbances, general convulsions, coma, and optic neu-

¹ Nothnagel, *Topische Diagnostik der Gehirnkrankheiten*, s. 6.

² This distinction was first made by Exner, *loc. cit.*

ritis or choked disk. These are due either to an increase of the intracranial contents and consequent pressure, or to an interference with the normal circulation in the parts not directly affected by the disease. They give no evidence as to the exact region of the brain which is affected, and are therefore termed *general symptoms* in distinction from local symptoms which are produced by the lesion of a limited area.

The *local symptoms* consist of disturbances of motion, of sensation, of sensory perception, of memory, and of speech. In cases of brain disease in which there is no increase of intracranial pressure a causal connection between local symptoms and limited lesions is easily established. When, however, the presence of a tumour or an abscess or a clot has increased the contents of the cranium, the *direct* local symptoms due to the affection of one area must be distinguished from *indirect* local symptoms due to the incidental affection of adjacent areas by irritation or disturbance of circulation.¹ Indirect local symptoms can usually be separated from direct local symptoms if the course of a case is considered. For example, if the case is one of a gradually increasing focus of disease, a tumour or abscess, the indirect local symptoms will precede the direct local symptoms and vary in intensity, extent, and duration, while the latter are permanent. Or if the case is one of hemorrhage occurring suddenly the indirect local symptoms will gradually subside, leaving only the direct local symptoms to indicate the actual area involved. When a lesion of one area sets up a general meningitis, the general and indirect local symptoms become so extensive and prominent as to prevent an accurate determination of the local area primarily involved. For this reason cases complicated by a meningitis do not afford reliable information regarding the function of limited areas, and are excluded from this collection.

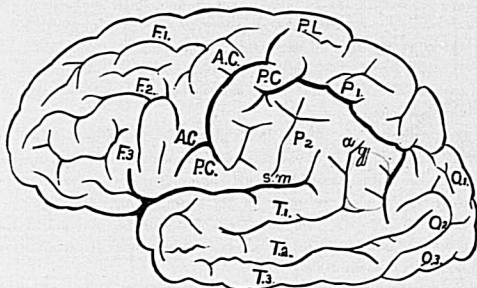
Lesions of the cortex may be pathologically divided into two classes, irritative and destructive, and each class offers important evidence for localization. An irritative lesion produces symptoms due to an increased activity of the area involved, *e. g.* spasms, convulsions, pain, paræsthesiæ, hallucinations of sight, hearing, etc., compulsory speech and delirium. A destructive lesion produces symptoms due to a loss of power in the area involved; *e. g.* paralysis, anæsthesia, blindness, deafness, loss of speech, and loss of memory. A lesion which at first irritates an area may after a time destroy it, and then the first set of direct local symptoms is followed by the second set, and a single case thus presents two distinct kinds of evidence of localization. Cases of Jacksonian epilepsy, in which one group of muscles is first convulsed and then paralyzed, afford examples of such a succession of symptoms.

The cases here collected have been classified according to the area of the cortex involved; lesions of the frontal, central, parietal, occipital, and

¹ This distinction is clearly drawn by Wernicke, *Lehrb. der Gehirnkr.*, vol. i. p. 284.

temporal regions being considered separately; an analysis of the symptoms being made after a statement of each group of cases has been given.

A description of the anatomy of the brain is remote from the present subject, but for the purpose of reference in the study of the cases the following figure illustrating the convexity of the brain and its convolutions



CONVOLUTIONS OF THE BRAIN.

Lateral View of the Left Hemisphere, after Bischoff. From a photograph.

F₁. Superior frontal.

F₂. Middle frontal.

F₃. Inferior frontal.

A.C. Anterior central.

P.C. Posterior central.

P.L. Paracentral lobule.

P₁. Superior parietal.

P₂. Inferior parietal.

Q₁. Superior occipital.

Q₂. Middle occipital.

Q₃. Inferior occipital.

s.m. Supra-marginal.

a.g. Angular gyrus.

T₁. Inferior temporal.

T₂. Middle temporal.

T₃. Inferior temporal.

is added, and its principal divisions are mentioned. The frontal lobe, whose sulci are seen to run in a general antero-posterior direction, has three prominent convolutions: the superior, middle, and inferior frontal convolutions. Posterior to this lobe two prominent convolutions, separated by the deep fissure of Rolando or central fissure, are seen extending from the vertex vertically downward to the fissure of Sylvius, and almost at right angles to the frontal convolutions. These are the anterior and posterior central convolutions,¹ which unite at their superior extremities to form the paracentral lobule. Lying posterior to the central region, and separated by the deep interparietal fissure, are two irregular collections of short convolutions extending backward to the occipital sulcus and limited below by the posterior extremity of the Sylvian fissure. These are the superior and inferior parietal lobules; and the convolution bordering the Sylvian fissure is called the supra-marginal convolution. The posterior

¹ Formerly named ascending frontal and ascending parietal convolutions.

apex of the brain is made up of the three occipital convolutions whose direction, like those of the frontal lobe, is antero-posterior. The temporo-sphenoidal lobe, divided by sulci into a number of convolutions running parallel to its long diameter, lies wholly below the Sylvian fissure, but is joined to the occipital and inferior parietal regions by short connecting convolutions of somewhat irregular shape and size.

Lying deep within the Sylvian fissure is the island of Reil, a series of five short vertical convolutions continuous above with the inferior extremities of the third frontal and both central convolutions, and below with the first temporal convolution, both of which groups of convolutions are so folded over as to cover in and conceal the island of Reil unless the fissure of Sylvius is opened.

On the median surface of the hemisphere the gyrus fornicatus borders the corpus callosum, while above it lies the paracentral lobule at the vertex. Anterior to the paracentral lobule the median surface of the first frontal convolution extends to the apex of the frontal lobe. Posterior to the paracentral lobule lie the precuneus, which forms the median surface of the superior parietal lobe, and the cuneus, which forms the median surface of the occipital convolutions.

In order to secure a uniformity of description in the location of the lesions in the cases here cited, the nomenclature just stated, which is that of Ecker, is substituted for that used by the authors quoted. In referring, therefore, to the frontal or parietal lobes it is to be understood that the central convolutions are not included.

Lesions of the frontal, temporal, occipital, and parietal regions will be first taken up, as they present no motor symptoms. Those of the central regions with the island of Reil will then be considered together, the direct local symptoms due to their disease being very numerous and marked.

I. FRONTAL LOBES.

Lesions affecting the three frontal convolutions may be classed together. Ever since the occurrence of the famous American crowbar case it has been known that destruction of these lobes does not necessarily give rise to any symptoms. That case is given in order to compare others with it.

CASE I. Destruction by a Foreign Body.—Male, æt. 48. A crowbar three and a half feet long, and one and one quarter inch in diameter was driven upward by a blast through the man's head, as he stood leaning forward and looking down. The bar traversed the cranium in a straight line from the left angle of the jaw to the centre of the frontal bone, just in front of the coronal suture. He was carried home, walked up stairs, and was able to relate his own history while the wound was dressed. The left eye was dull and glassy, and after seeing light dimly for nine days, he lost vision in it completely. He vomited soon after the wound was dressed, and in the evening of that day both his legs were constantly convulsed. The day after, he had much pain in the head and some difficulty of speech. Then delirium and all the symptoms of encephalitis set in, but he gradually recovered, and seven weeks after the injury was able to get up and to walk out. At this time, it was noticed that he was somewhat childish and

uncontrollable. At the end of sixteen months the wounds were healed, and the patient had recovered his health and mental vigour. A depression in the scalp, which pulsated, remained; also blindness of the left eye, with ptosis and immobility of the eyeball. He lived twelve years, being able to work as a farm labourer all the time. It was noticed that his disposition was altered, and that he was irritable, easily excitable, and emotional. His last illness was short, and was accompanied by general convulsions.

Autopsy.—The skull was obtained some time after death, and careful measurements demonstrated that the lesion must have involved the whole central portion of the left frontal lobe, and a part of the apex of the left temporal lobe, and also a small part of the right frontal lobe in its posterior part, adjacent to the longitudinal fissure. It is also probable that the anterior cornu of the left lateral ventricle was laid open. The longitudinal sinus must have been pierced. (H. J. Bigelow, *Amer. Journ. Med. Sci.*, July, 1850. J. B. S. Jackson, *Catalogue of the Warren Anat. Museum*, Boston, 1870, p. 145.)

The indirect local symptom of spasms of the legs, which occurred during the first twenty-four hours, indicates an irritation of the motor centres in the paracentral lobules. The absence of permanent paralysis, however, demonstrates the fact that the lesion did not reach the motor area. The same absence of motor symptoms is noticeable in the following cases:—

CASE II. *Bullet remaining in the Brain Four Years.*—Male, æt. 27, was shot in the head in 1874, and suffered from acute encephalitis for a short time, but then recovered. For four years the patient was perfectly well, physically and mentally. In July, 1879, after a short illness, he died.

Autopsy.—The bullet inclosed in a cyst was found lying in the white matter of the right frontal lobe in its centre. A canal ran directly through the lobe in an antero-posterior direction to the ball. It was patent throughout. Three spiculæ of bone were found near the ball. The right frontal lobe was atrophied, and fully one-third smaller than the left. (J. E. Gibson, *Med. Record*, vol. xvi. p. 540. *Nashville Journal of Med. and Surg.*, xxiv. p. 209.)

CASE III. *Bullet remaining in the Brain Three Months.*—Male, æt. 39, was wounded December 12, 1862, by a ball which destroyed the right eye and entered the brain. After three weeks, the patient was up and about in perfect health, but occasionally had a little pain over the left orbit. On February 6, 1863, he had a chill, but no cerebral symptoms developed until the 10th, when he became delirious, passed into a state of coma, and on the 15th died.

Autopsy.—The ball was found between the sphenoid bone and the orbital plate of the frontal bone. Over the ball, at the base of the left frontal lobe, was an abscess which contained two drachms of pus, and had involved the orbital convolutions. (S. W. Gross, *Amer. Journ. Med. Sci.*, July, 1873; quoted from *Circular No. 6*, S. G. O., p. 15.)

CASE IV. *Bullet remaining in the Brain Eleven Months.*—Male, æt. 32, shot himself in the forehead, March 9, 1872, and for six weeks suffered from local inflammation in the wound, after which he left the hospital cured, without any brain symptoms. In January, 1873, he began to complain of headache in the frontal region and heaviness of the head. On January 23, was admitted to the hospital and found to be stupid and listless; skin cool, and extremities cold; pulse rapid and feeble. He had incontinence of urine and feces. On the 28th, erysipelas of the head, beginning at the old scar, set in; the patient became semi-comatose, and then delirious, and died February 13th.

Autopsy (12 h. p. m.).—Dura adherent to the frontal bone. On the under surface of the left frontal lobe of the cerebrum was a large sac containing six ounces of pus, and partly filling the left anterior fossa as far back as nearly to reach the Sylvian fissure. In front of it lay the bullet encysted, and several fragments of bone. The portion of the brain anterior to this was adherent to the dura. The sac was not formed by the dura, but was independent of it. The ventricles did not communicate with the sac. (R. E. Young, *Jefferson City Hospital Report. St. Louis Med. and Surg. Journal*, vol. x. p. 612.)

CASE V. *Foreign Body in the Frontal Lobe.*—The breech-pin of a gun four and seven-tenths inches long and one-half inch broad was forced through the right eye of a boy nineteen years old, on September 18, 1881. It broke the orbital plate, and perforating the frontal lobe of the brain to a depth of one and a half inch, remained in the nose orbit and cranium. After lying unconscious for four days, the boy came to his senses, and recovered, no brain symptoms whatever resulting from the presence of the pin. In February, 1882, he applied at the N. Y. Eye Infirmary, in order to have the deformity of his face repaired by a plastic operation. During the operation the presence of the pin was discovered, and it was removed. Suppuration of the brain followed, and collections of pus had to be evacuated by incisions into the brain, and finally by the passage of a drainage-tube through a fenestrum made in the frontal bone three inches above the right external angular process, through the brain tissue and out of the orbit. Paralysis of the entire left side, which had developed three weeks after the operation, was relieved to some degree by the through drainage, but returned in one week, and was accompanied by partial anæsthesia of the left arm. The special senses were not affected. Five weeks after the operation the boy began to be stupid, and indifferent to the state of the bladder and rectum, and then sank gradually and died. He was perfectly intelligent and conscious, though indisposed to talk, up to within two hours of his death.

Autopsy.—Around the two openings in the skull there was a hemorrhagic pachymeningitis, with adhesion of the membrane, so that no pus had entered the subdural space. Elsewhere the dura was normal. There was a purulent leptomenigitis of the base, and of the convexity around the fenestrum. The right frontal lobe was sunken in, there being a loss of substance involving the second and third frontal convolutions beneath the fenestrum, and the orbital convolutions over the opening in the orbital plate and the white matter between these two points where the drainage-tube had been passed. The interior of the right frontal lobe was destroyed and occupied by a cavity with soft sloughing walls of brain tissue. This cavity had undermined the anterior central convolution, had involved the anterior extremity of the nucleus caudatus and the adjacent internal capsule. The substance of the left hemisphere was moist. After the brain had been hardened in chromic acid it was found that the cortex of the central convolutions was normal, but that the anterior portion of the internal capsule was destroyed.—H. B. Noyes, *Amer. Journ. Med. Sci.*, July, 1882.

This case is no less remarkable than the crowbar case. The presence of the breech-pin in the brain was unknown for five months, and the great destruction of tissue in the frontal region caused no symptoms. When encephalitis set in, and advanced toward the fibres coming from the anterior central region, local symptoms at once developed, consisting of paralysis and anæsthesia in the opposite side of the body. The case illustrates the difference between lesions of the frontal and lesions of central region, in the character of the symptoms produced.

In these cases, foreign bodies entered and destroyed portions of the frontal lobe, without producing paralysis, anæsthesia, or disturbance of the special senses. Mental symptoms, which may be summed up as a deficiency of self-control, were manifest in two of the cases. In the following cases, the frontal lobes were the seat of abscesses of varying size:—

CASE VI. *Abscess of the Frontal Region.*—Female, æt. 28, had suffered for two years from occasional frontal headache. In March, 1880, symptoms of orbital abscess appeared and were relieved by opening the abscess. The wound healed perfectly. On April 4th the patient began to suffer from severe headache and vomiting, which were soon followed by general feebleness and stupor; with irregular respiration and slow irregular pulse. Patient had no fever, no convulsions, no paralysis, no aphasia, no eye symptoms, and was conscious. In this condition she

remained until April 14th, when partial paralysis of the left third nerve appeared, the eyelid drooped, the eye was turned outward, and the pupil was dilated. At this time no other evidence of paralysis was found. There was no anæsthesia. There were no choked disks. Soon after Cheyne-Stokes respiration began, the patient became comatose, and died April 15th.

Autopsy.—Over the left orbital plate the dura mater was adherent to the brain. In the left frontal lobe was found an abscess of the size of an English walnut, which involved the cortex of the orbital lobule and of the middle frontal convolution. Its anterior, inferior, and external walls were composed of thinned cortex, the remaining walls of white matter. Its diameter was 38 mm., and it was lined by a membrane 1–2 mm. thick. It had destroyed the entire white centre of the frontal lobe to within 10 mm. of the island of Reil and 8 mm. of the nucleus caudatus, but had not involved a portion near the convexity. Broca's centre of speech in the inferior or third frontal convolution escaped. (E. C. Seguin, *Archives of Medicine*, Feb. 1881.)

CASE VII. Abscess of the Frontal Region.—Male, æt. 24, entered the Massachusetts General Hospital for the removal of a tumour of three years' growth, from his forehead, which had followed a fall. The tumour was a smooth, ivory exostosis, occupied more than one-half of the forehead on the left side, measuring 5 inches across and being $2\frac{1}{2}$ inches thick. It had displaced the left eye downward and the sight of this eye was impaired. There were no cerebral symptoms at any time, but it was noticed that the patient was querulous, complaining, and timid, and a little slow of speech. The tumour was removed October 17. The patient did well up to November 11, when meningitis set in and caused his death on the 24th.

Autopsy.—Recent meningitis was found. An exostosis had projected internally, compressing the left frontal lobe of the brain. The whole frontal lobe was the seat of an abscess. The inflammation had extended to the right hemisphere at one point, where there was an effusion of pus on its median surface. (R. M. Hodges, *Boston Med. and Surg. Journ.*, vol. lxxi. 413.)

CASE VIII. Abscess of the Frontal Region.—Male, was hit with much force directly on the nose, which was flattened by the blow. During the next three weeks he suffered from severe headache and general debility, and was constipated. On April 1st, twenty-one days after the injury, he died very suddenly.

Autopsy.—In the left frontal lobe an abscess was found as large as a hen's egg, filled with pus and broken-down cerebral matter. It communicated with the anterior cornu of the lateral ventricle, and had also opened externally through a sinus situated at the anterior end of the corpus callosum, $\frac{1}{8}$ inch to the left of the longitudinal fissure. The lateral and fourth ventricles were filled with pus, which was also effused over three-quarters of the base of the brain. Death had been due to the rupture of the abscess into the ventricles. (Lidell, *Amer. Journ. of Med. Sci.*, July, 1883; quoted from Circular No. 3, Surg.-Gen. Office, U. S. A., 1871.)

CASE IX. Abscess of the Frontal Region.—Male, æt. 31, suffered from chronic otitis media, resulting in the formation of a mastoid abscess, which opened into the lateral sinus and produced pyæmia, with multiple infarctions in the lungs and abdominal viscera. "The patient was carefully watched for indications of cerebral disease because intracranial abscess was suspected; but there was no paralysis of motion or sensation, no aphasia, and no delirium until exhaustion set in. Patient suffered from severe pain in the right side of the head and in the ear."

Autopsy.—An abscess was found "in the left frontal lobe just at the border of the white substance," 1 cm. in diameter. "The debris in the centre of the infarctus was composed of leucocytes and cholesterine crystals. The tissue for some distance around the infarctus was pale and devoid of blood, the vessels not containing a single blood corpuscle." An inflamed artery was found about an inch below the infarctus. Numerous cholesterine crystals were found in the substance of the brain. (D. W. Prentiss, *Amer. Journ. of Med. Sci.*, April, 1882.)

CASE X. Abscess of the Frontal Region.—Male, æt. 18, fell on February 9th, and struck the right side of the head. Patient was unconscious for ten minutes, but then recovered. On the 11th, he was free from pain and rational. On the

17th, pain at the base of the skull began, with some stiffness of the limbs. On the 22d, he had become drowsy and apathetic, but did not suffer. On March 6th, ptosis of right eyelid with dilatation of the pupil developed, the patient began to vomit, and it was noticed that he was sulky and morose instead of cheerful as formerly. On the 17th, he became suddenly insensible; resp., 37; pulse, 137; face and hands congested and cold. The urine was then found to contain albumen and casts. He recovered consciousness after a few hours. After this attack the patient suffered much from headache, drowsiness, and pain in the left side of his face and in the left hand. At times the right eyelid was swollen, the eyeball protruded, and the pupil was dilated. He became stupid and disinclined to talk. Toward the close of life his head was constantly turned to the right, and attempts to turn it to the left caused pain. On April 26th he died.

Autopsy.—Dura was adherent to the brain over the right orbital bone, which was fractured. The right frontal lobe was fluctuating and its convolutions flattened. Incision into it showed the presence of an abscess containing 100 cc. of green pus in a well-defined capsule, which extended to but did not perforate the lateral ventricle, and did not involve the great ganglia. The brain below it was very thin, but above it there was a thick layer of normal substance. (Edes, *Boston Med. and Surg. Journ.*, vol. cii. p. 447.)

CASE XI. Abscess of the Frontal Region.—Male, æt. 9, was struck on the head near the right frontal protuberance, and stunned by the blow, but did not lose consciousness. He vomited some afterwards, and for several days had a large ecchymosis on the forehead. When this subsided he appeared as well as usual. He continued to be perfectly well for four months, the only unusual occurrence being an occasional intense congestion of the face. At the end of this time he had an attack of acute rheumatism, during which he went into a state of coma and died in one week.

Autopsy.—The meninges were thickened over the right frontal lobe. In the right frontal lobe a cavity was found as large as a pigeon's egg, occupying the white substance between the anterior superior part of the corpus striatum and the cortex, and approaching the surface of the brain anteriorly. The walls of the cavity showed traces of chronic inflammation. The cavity was filled with a dark clot. It was considered the cavity of an old abscess, into which the rupture of vessels in its walls had caused the fatal hemorrhage. (F. G. Smith, *Proceedings of Phila. Path. Soc.*, March 24, 1870, vol. iii. p. 165.)

CASE XII. Abscess of the Frontal Region.—Male, æt. 35, was struck on the forehead and stunned, and for the next few weeks suffered from all the symptoms of acute encephalitis. From this he recovered completely and went to his business for six months; the only changes noticed in him being that he was much more talkative than before the injury, and that his pulse was now slow, rarely exceeding 50. After six months he was taken ill and died in a few days.

Autopsy.—The right frontal lobe contained an encysted abscess which extended from the extremity of the lobe to the fissure of Sylvius. A very thin lamina of softened gray matter surrounded the cyst. The dura was adherent to the right frontal lobe. (Bartholow, *Journ. Psycholog. Med.*, vol. ii. p. 360.)

In these cases destruction of the frontal lobe of greater or less extent occurred from softening or abscess. In none of these cases were paralysis, aphasia, loss of sensation, or sensory disturbance present as a consequence of the local lesion. In two cases an indirect local symptom, viz., paralysis of the third nerve, occurred from pressure upon the nerve in its course. In four cases mental symptoms, consisting of an undue excitability and a lack of self-restraint, were noticed.

Hemorrhage into the frontal lobe is a rare lesion, and no cases were found on record. Cases of tumour of the frontal lobe are numerous.

CASE XIII. Glioma in the Frontal Lobe.—Female presented no symptoms of brain disease during a long stay in the almshouse, but died very suddenly.

Autopsy.—A glioma of the size of a small orange was found in the white matter of the frontal lobe anterior to the anterior central convolution.¹ (Janeway, *Trans. N. Y. Acad. of Med.*, vol. iii. p. 187.)

CASE XIV. *Sarcoma in the Olfactory Groove.*—Female, æt. 50; suffered for several months before her death from epileptic attacks preceded by an aura consisting of a feeling as if the patient were walking backward. Constant severe headache, and persistent vomiting were prominent symptoms. There was no paralysis nor disturbance of vision; optic disks were normal. Patient died in a convulsion.

Autopsy.—A sarcomatous tumour, 4 cm. by 3 cm. in diameter, was found in one olfactory groove, which had destroyed the olfactory nerve, had involved the pia, and had softened the brain around.² The cerebellum was congested and softened. (H. C. Wood, *Phila. Med. Times*, vol. iv. p. 471.)

CASE XV. *Sarcoma in the Frontal Lobe.*—Female, æt. 45. Several years before the outset of the symptoms she had a fall and injured the right frontal bone. In 1871 she had a sudden attack of vertigo, with momentary blindness; and after recovering from this a gradually progressing failure of sight developed. In February, 1872, choked disks were found in both eyes. The only other evidence of cerebral disturbance was an occasional attack of vertigo. She became blind in 1874; and died suddenly, January 17, 1876.

Autopsy.—A sarcoma of the size of an English walnut was found in the frontal lobe of the right hemisphere attached to the dura, just above the orbital plate. A sharp-pointed osseous growth extended upward from the orbital plate, and to this the dura and the tumour were adherent. (A. Mathewson, *Trans. N. Y. State Med. Soc.* 1878, p. 170.)

CASE XVI. *Sarcoma in the Frontal Lobe.*—Male, æt. 27; suffered from severe headache for a year, and then noticed a failure of vision, especially in his right eye. This increased very rapidly, so that in fourteen days vision was reduced to mere perception of light in the right eye, and in a month the eye was totally blind. The left eye was then affected, and in thirty-two days vision was reduced from $\frac{1}{2}$ to $\frac{1}{4}$. In three months this eye was also totally blind. Hearing then became affected, and by the end of the sixth month from the first observation the patient was totally deaf. The sense of smell was also lost during this period. The other cranial nerves were not affected. Toward the close of life taste was lost, and his speech became incoherent; he lost flesh, and at the end of nine months, i. e., twenty-one months after the headache began, he died of exhaustion.

Autopsy.—In the right frontal lobe of the brain a tumour was found involving its inferior portion, and adherent to the dura mater over the cribriform plate; it was about 5 cm. in diameter. Microscopic examination showed it to be a fibrosarcoma. There was much hyperæmia of the base of the brain as far back as the anterior part of the pons; other parts of the brain normal. (L. Howe, *Buffalo Med. and Surg. Journ.*, Feb. 1882.)

CASE XVII. *Sarcoma in the Frontal Lobe.*—Female, æt. 50; suffered from headache, vertigo, and attacks of falling, without convulsions (*petit mal*). She gradually lost the sight in both eyes, and ophthalmoscopic examination showed the presence of choked disks. She had no paralysis or aphasia.

Autopsy.—A sarcoma was found on the surface of the right frontal lobe, which pressed upon the inferior and middle frontal convolutions at about their middle part. (J. C. Shaw, *Trans. Amer. Neurol. Assoc.* 1877. Report in *Journ. Ment. and Nerv. Dis.*, July, 1877.)

CASE XVIII. *Fibroma in the Frontal lobe.*—Male, æt. 35, syphilitic, had a fall in June 1877, and hit his head. In August, after a spree, suffered from headache and vomiting. His health gradually declined, and for nine months prior to September, 1878, he was in the Pennsylvania Hospital. While there he had headache, which was worse at night; apparent loss of power in his limbs, especially of the right side; gradual failure of vision, first in right and then in left

¹ The side on which the tumour lay is not stated.

² The side on which the tumour lay is not stated.

eye, until he was totally blind; mental hebetude and uncertainty with a tendency to hallucinations; spasmodic contraction in the muscles of the neck, forearm, and eyes; nystagmus; and involuntary discharges. There was no vomiting, no fever, no vertigo, no convulsions, no aphasia, no paralysis of the cranial nerves. In September, 1878, he was transferred to the Philadelphia Hospital. He usually lay on his back with his head retracted. There was no muscular atrophy. His appetite was good; he was constipated; he did not notice his involuntary discharges. There was no cranial nerve paralysis excepting loss of smell and of vision. Ophthalmoscopic examination showed choked disks and retinal hemorrhages. Movements of his hands and arms were possible, but wanting in strength and accuracy; he fumbled with his hands constantly. His legs were usually extended and motionless, but sometimes they were found drawn up and rigid, when they could be straightened with difficulty. Passive motions were resisted. Sensation did not appear to be affected, though he was too stupid to be tested accurately. His intellect was much impaired. Formerly he had been intelligent and energetic, now he was slow, and seemed to have difficulty in receiving mental impressions and in directing voluntary movements. The faculty of attention was almost gone, and his attention was only to be fixed by vehement command. He could hear, but it was necessary to speak very loud in order to call out a mental response. He appeared to be in a dazed condition. He was not aphasic, and spoke clearly in a firm voice without omitting words in a sentence. But in answering he seemed unable to retain the same idea, or follow a line of thought. He would not wander, but would stop speaking. He was very emotional. He would at times have outbursts of speech, saying a few sentences very loud and then stop suddenly. Exclamations of this kind would be repeated every few minutes for several hours. They consisted in oaths, demands for food, or references to past events. No further symptoms were noticed: he grew weaker, and on October 16 died. The temp. record showed an evening rise to 99° or 101° . The surface temp. of his head was 1° to $1\frac{1}{2}^{\circ}$ F. higher over the right frontal region than elsewhere. This was frequently verified.

Autopsy (6 hours p. m.).—No meningitis. Vessels of brain congested. Looking at the brain from above, a large bloody looking tumour was seen lying obliquely across the right frontal lobe, and involving the anterior upper half of the superior frontal, and the anterior upper and inner half of the middle frontal convolutions. It had also destroyed a small segment of the gyrus fornicatus where it bends around the ant. genu of the corpus callosum; and finally it had invaded the anterior portion of the corpus callosum for a distance of $\frac{1}{2}$ inch; the diseased mass barely touching the gyrus fornicatus of the opposite side. It was overlapped by the outer and posterior parts of the frontal convolutions, and did not encroach upon the inferior frontal or anterior central convolution. It did not project above the level of the brain. The hemispheres were thrust apart in front. The membranes over the tumour were destroyed. The basal convolutions were normal. It was irregular, nodular, and pyriform in shape, its apex being in the corpus callosum and base in the convexity. It was firm and hard, its cut surface being a mottled-red colour. Dimensions were $3\frac{1}{2} \times 3 \times 2\frac{1}{2}$ inches; weight 7 oz. The lateral ventricles contained a few drops of blood, and the choroid plexus was engorged. The corpora striata and optic thalami were congested, especially on the right side, and the corpora quadrigemina were also red. The brain as a whole was firm and consistent, and in all other parts normal. The cerebellum was small in ratio to the cerebrum.

Microscopic examination showed it to be a fibroma. Examination also showed the optic papillæ swollen, and the subvaginal spaces dilated. There were a few sclerotic spots in the medulla and pons. (C. K. Mills, *Phila. Med Times*, vol. ix. p. 184.)

The symptom of compulsory speech present in this case is very rare. The mental symptoms are carefully recorded, and are typical of this class of cases.

CASE XIX. Gumma in the Frontal Lobe.—Female, æt. 32, syphilitic, suffered for nine months prior to her death from constant headache, epileptic convulsions

increasing in frequency, dimness of vision in both eyes due to choked disks, and exophthalmos. No other symptoms. After a convulsion she became comatose and died.

Autopsy.—At the anterior portion of the left frontal lobe, a large gummy tumour growing in the dura was found which had extended into the brain substance adjacent. The brain substance near it was softened. The left lateral ventricle was distended by serum, and its floor was softened. The veins of the left hemisphere were distended. The meninges were normal and not adherent, excepting at the situation of the tumour.

Microscopic examination showed the anterior and middle lobe of the left hemisphere to be "in a condition of simple decay produced by maceration." This was most advanced in the vicinity of the tumour.¹ (H. Knapp, *Arch. of Ophthalm.*, vol. iv. p. 245.)

CASE XX. *Gummata of the Frontal and Parietal Lobes.*—Male, æt. 36, syphilitic, suffered from severe continuous headache with sensitiveness to pressure over the frontal and parietal regions of the cranium. His faculty of attention was wanting, and continuous thought was impossible. He was very emotional and cried often. There was general hyperæsthesia. His sight was impaired and pupils contracted. Toward the close of life there was fever with delirium, and patient died comatose. (Duration of symptoms not stated.)

Autopsy.—A gumma $1\frac{1}{4}$ inches in diameter was situated over and had involved the superior anterior part of the superior and middle frontal convolutions on the right side. Here the pia and dura were adherent to the tumour, and there was a pachymeningitis surrounding it. A second gumma $\frac{3}{4}$ inch in diameter was found adherent to the pia, in the right supra-marginal convolution, at the extreme posterior point of the horizontal branch of the fissure of Sylvius. A third gumma $\frac{3}{4}$ inch in diameter adherent to the pia and dura, was situated in the retro-central fissure, $\frac{1}{2}$ inch behind the junction of the upper and middle thirds of the fissure of Rolando. (C. K. Mills, *Archives of Medicine*, Aug. 1882.)

The hyperæsthesia—a symptom not present in any other case of frontal lesion—must be referred to the irritation of the parietal cortex, and will be considered again when lesions of this part are studied.

CASE XXI. *Tumours of the Frontal Lobes.*—Male, æt. 30, had suffered for more than a year from constant vomiting without nausea, and gradually increasing dimness of vision. Admitted to hospital March, 1872. In May he had become totally blind, his pupils being dilated, and not reacting to light. His face was very sad, he never smiled, and never conversed except to answer inquiries. The expression was neither one of pain nor of idiocy, but was very pathetic. If questioned he answered correctly in a clear low tone and very distinctly. His memory of past events was good, but of recent occurrences was poor. "His intellection was retarded, but not absent nor irrational." His hearing was perfect. There was no paralysis, aphasia, dysphagia, or staggering, nor was there any diminution of sensibility or hyperæsthesia. On May 29, he was very restless, walking constantly about the ward, and obeying the calls of nature in any place without hesitation or question, though his sphincters were under control. In the evening he had a convulsion and died.

Autopsy.—All the ventricles were distended with serum. There was a hard nodulated mass of the size of a walnut in the white substance of the left frontal lobe surrounded by gelatiniform substance and non-fluent pus. In the same location precisely in the right frontal lobe was a similar mass the size of a hickory-nut surrounded by colloid matter and softened white brain matter not quite purulent. There was no odour to the brain. There was an occlusion of the basilar artery $\frac{1}{4}$ inch in length at the middle of the pons. The central lobes were bloodless both on their surface and interiorly. *Puncta vasculosa* were more numerous in the left middle lobe than in the right. The hard masses were situated just exterior to the olfactory bulbs, and must have compressed these organs, but being anterior to the fissure of Sylvius could not have pressed on the optic

¹ Probably a post-mortem condition is intended.

nerves or chiasm. The anterior cornua of the lateral ventricles were pressed upon but not ruptured. (D. Wooster, *Pacific Med. and Surg. Journ.*, Aug. 1872.)

CASE XXII. *Tumour of the Base involving the Frontal Lobe.*—Female, æt. 20, suffered from constant vomiting for several months without known cause. Then she became unable to hold anything in her hands and unable to walk well, and three days after her sight and her speech were impaired. She was then admitted to the hospital March 27. Previous history was doubted. Present condition is as follows: In the right eye light is not perceived, and in the left eye vision is much impaired; Snellen's type 6½ is seen at 6 inches; ophthalmoscopic examination shows neuro-retinitis of both eyes, most marked in the right eye; pupils natural; smell is impaired. The right half of the face is anæsthetic, and feels numb and swollen. She has much headache especially in the frontal region, and on the right side. There is no paralysis of the face. The tongue is protruded with difficulty, and deviates to the right side. Taste and hearing are perfect. Pulse is 46 and irregular; resp. 15; extremities are cold. There is no loss of motor power, and she can walk with tolerable certainty if led. There is no loss of sensation except in the face. No aphasia. The patient improved slightly during the first week, the pulse becoming regular and faster. Headache and vomiting became more severe during the next month, and with no further development of symptoms the patient sank into a state of coma, and died May 5.

Autopsy (12 hours post-mortem).—A tumour was found on the base of the brain lying under and compressing the left frontal lobe. It filled the anterior fossa extending from the falx cerebri to which it was adherent, over the sella turcica to the right petrous bone. The anterior part of the tumour was hard, the posterior soft. The posterior part had extended across to the right side 1 inch, producing a corresponding cavity in the brain. It was 3 inches long, and had compressed the left olfactory nerve, the right V., and the Gasserian ganglion, the optic chiasm, and the cavernous sinus. No microscopic examination. (Williams, *Med. Record*, vol. iii. p. 30.)

The only symptom which might be considered a local symptom of cortical lesion in this case, is the paralysis of the right xii. nerve. Considering the situation of the tumour on the base and its extent, it is impossible to determine whether this was due to indirect pressure on the medulla or to direct upward pressure upon the motor area for the tongue. This case illustrates the absolute importance of accurately describing the convolutions which are involved in any lesion.

CASE XXIII. *Tumour of the Base involving the Frontal Bone.*—Male, æt. 20, after taking cold from exposure was attacked with paresis of the left vi. n. producing diplopia. This disappeared in three weeks. Six months later a second attack of diplopia occurred, which was found to be due to paralysis of the r. iii. n. and which became permanent. It was soon followed by attacks of severe headache occurring daily for some hours. No other symptoms were noticed until nearly three years later, when slight paresis of the left leg developed, and a disturbance of vision which was found to be due to a beginning optic neuritis in the left eye. Nine months after this the patient had a sudden attack of the left hemiplegia without loss of sensation. At this time there was total right iii. n. paralysis, nystagmus in left eye, dilated pupils, and double choked disk. During the following months his condition became worse. Partial anæsthesia of the paralyzed side developed—patient had difficulty in swallowing and in speaking, a few words only being spoken, and he became blind in both eyes. He was confined to his bed, though able to stand and walk with assistance, and the headache and insomnia caused much suffering. Eight months after the hemiplegic attack he died.

Autopsy.—The dura was thickened and adherent on the left side near the longitudinal sinus. The pia was congested. A tumour 6 cm. thick and 15 cm. in circumference extended upon the base of the brain from the anterior clinoid process to within 2 cm. of the foramen magnum, and encroached on the apices of

the petrous bones. It was under the dura, but had pressed up the parts above it. It had two lobes, the right being larger. It was hard and dense. It had compressed the optic nerves, the chiasm and tracts, and the crus, and also the olfactory nerves. These parts were thin and atrophied. A second tumour the size of a walnut was found embedded in the anterior inferior surface of the left hemisphere and surrounded by a large clot of blood. (J. A. Spalding, *Arch. of Ophthalm.*, vol. ix. p. 160.)

The paralysis was due to pressure upon the right crus cerebri, as was indicated during life by the combination of left hemiplegia with right iii. n. paralysis. None of the local symptoms can, therefore, be connected with the tumour in the frontal lobe.

In these cases tumours, situated in various parts of the frontal lobe and involving both its cortex and its substance, were present for a considerable time, but did not give rise to paralysis, aphasia, disturbance of sensation, or of the senses, except sight. In all cases they produced an increase of the intra-cranial pressure and the general symptoms consequent upon it. The most noticeable of these symptoms was the choked disk and the accompanying gradual development of disturbance of vision. The loss of sight is to be ascribed to this cause, and not to any destruction of the visual area, because in its progress and character it differs from the blindness produced by lesions of the visual area; and because destruction of identical portions of the frontal lobe by lesions not increasing the intra-cranial pressure failed to produce blindness. The visual area cannot, therefore, be located in the frontal lobes. In two of these cases epilepsy was the prominent symptom. This may be produced by any lesion in any location, as will be shown in considering lesions of other areas. In two cases an indirect local symptom was present, viz., loss of smell, due to pressure of the tumour upon the olfactory nerve.

In reviewing the cases here cited of lesion of the frontal region, it is noticeable that decided mental disturbance occurred in one half. This did not conform to any one type of insanity. It is rather to be described as a loss of self-control, and a consequent change of character. The mind exercises a constant inhibitory influence upon all action, physical or mental; from the simple restraint upon the lower reflexes, such as the action of the sphincters, to the higher control over the complex reflexes, such as emotional impulses and their manifestation in speech and expression. This action of control implies a recognition of the import of an act in connection with other acts; in a word, it involves judgment and reason, the highest mental qualities. By exhibiting all but one set of impulses it enables one to fix attention upon a subject, and hold it there. It is the possession of these qualities which chiefly distinguishes a normal man from an idiot, or from the lower animals. Memory and the association of memories, may be well developed in many animals. Memories are as various in kind as the senses through which the original perceptions which are remembered were acquired. A loss of these various kinds of memory is found chiefly in those forms of disease which affect the

areas of the brain, whose function is that of sensory perception. Cases are on record, and will be cited, in which one class of memories, *e. g.*, memories of objects seen, letters, faces; or memories of things heard, language, music; or memories of motions acquired by practice, writing; have been lost, while all other kinds of memory remained, and mental action was good. These facts demonstrate the location of memories in the various sensory areas of the cortex. Memory does not appear to be affected in disease of the frontal lobes. In respect of judgment and reason the power of man surpasses that of the lower animals. The brain of man differs from that of the lower animals and of idiots chiefly in the greater development of the frontal lobes. It seems probable, therefore, that the processes involved in judgment and reason have as their physical basis the frontal lobes. If so, the total destruction of these lobes would reduce man to the grade of an idiot. Their partial destruction would be manifested by errors of judgment and reason of a striking character. One of the first manifestations would be a lack of that self-control which is the constant accompaniment of mental action, and which would be shown by an inability to fix the attention, to follow a continuous train of thought, or to conduct intellectual processes. It is this very symptom which was present in one-half of the cases here cited. It occurred in all forms of lesion; from injury by foreign bodies, from destruction by abscess, from compression and softening due to the presence of tumours; and, therefore, cannot be ascribed to any one form of disease. It did not occur in lesions of other parts of the brain here cited. Many other cases must be carefully studied before any conclusion regarding this symptom can be reached. But its presence in such a large number of these cases warrants the suggestion that in cases of suspected lesion of the frontal lobe, the mental condition of the patient as shown by his acts of judgment and reason should be carefully examined, and a change of character or behaviour accurately noted.

Aside from the disturbance of mental action the symptoms of lesion of the frontal lobes are chiefly negative. The absence of disturbances of motion and sensation and of the special senses warrants the statement that the motor and sensory areas of the cortex do not lie in the frontal region. These conclusions agree in all respects with those of foreign observers.

No cases of pure motor aphasia associated with a lesion limited to the posterior part of the left inferior or third frontal convolution, such as are cited by Nothnagel and Charcot, are found in the American records. The cases of aphasia recorded were associated with paralysis, and the lesion was extensive, involving portions of the central region. In all the cases of aphasia, which conform to the conditions here adopted, a lesion of the left Sylvian region was present, and in the majority of them the third frontal convolution was involved.¹ There is therefore no case in the

¹ Fifty cases of aphasia were collected by Seguin in the *Journ. of Psych. Med.* 1868. Of these, nine are accompanied by a record of autopsy. Of these nine, none complies

American record which opposes the statement of the foreign observers that lesion of the left third frontal convolution produces ataxic aphasia without paralysis. But inasmuch as the third frontal convolution was not affected *alone* in any case, no statement of its function is warranted.

The diagnosis of lesions of the frontal convolutions must rest upon the presence of general symptoms of cerebral disease and of mental disturbance, and also upon the absence of motor and sensory disturbance.

II. TEMPORAL LOBES.

Lesions affecting the temporo-sphenoidal lobes will be next considered. They may be divided into two classes: first, those affecting the convolutions upon the base of the brain, the temporo-sphenoidal convolutions; and secondly, those affecting the convolutions lying below the Sylvian fissure on the convexity, the first and second temporal convolutions.

CASE XXIV. *Softening of the Temporo-sphenoidal Lobes.*—Female, æt. 40, suffered from the age of 10 from epileptic attacks, which occurred four or five times a year, and consisted of general convulsions. The first attack occurred after a fall when she struck her head, and was unconscious thereafter for some hours. No scar was visible on the head. She always had an aura of a peculiar character before the attack. She suddenly perceived a disagreeable odour, sometimes of smoke, sometimes of a fetid character, and quite uncomplicated by other sensory warnings. She was under observation two years, and finally died of phthisis.

Autopsy.—The dura mater was thickened and opaque in spots, and on the base was adherent to the temporo-sphenoidal lobes. There was an excess of fluid in the ventricles, and the brain was small. The adhesion of the membranes was most marked on the right temporo-sphenoidal lobe somewhat posterior to its apex. At this point a decided shrinkage of tissue was discovered with depression, the induration involving the uncinate gyrus and parts of the adjacent convolutions. The basal ganglia and motor tracts were normal, and the olfactory nerves were not involved. (A. McLane Hamilton, *N. Y. Medical Journal and Obstetrical Review*, June, 1882.)

This case is of much interest, as the perception of sensations of smell has been localized by Ferrier in animals in the region here involved. While sensory aura are not rare, it is only in a few cases that an autopsy has indicated the localization of the sense irritated, by demonstrating the area of the brain involved. Hamilton has collected a number of such cases in the article from which this case is quoted. They are either foreign cases, or American cases in which more than one lesion was found, and therefore cannot be admitted to this collection. A conclusion that the area for the sense of smell lies in the inner part of the base of the temporo-sphenoidal lobe is hardly warranted from the small number of cases recorded. But when considered in connection with the physiological conclusions it may be recorded as a possible symptom of disease in this region. Its

with Nothnagel's conditions; five of the cases dying within eighteen days, and the other four presenting extensive lesions not limited to the cortex. They are therefore not available for purposes of cortical localization, though in all the left Sylvian region was involved.

absence in other cases of such disease cannot be affirmed, as few observers have been sufficiently careful in the examination of cases to test this sense.

CASE XXV. Abscess of the Temporo-sphenoidal Lobe.—Male, æt. 25, had a chronic otitis media which led to the development of cerebral symptoms; headache, vomiting, fever, constipation, and slow pulse. There was no impairment of sensation or motion during his illness, which lasted fourteen weeks.

Autopsy.—An abscess was found situated above the petrous portion of the temporal bone on the right side. The brain about the abscess in all directions was in a condition of white softening, which extended nearly to the posterior part of the hemisphere. (E. H. Clarke, *Arch. of Scien. and Prac. Med.*, vol. i. p. 50.)

CASE XXVI. Abscess of the Temporo-sphenoidal Lobe.—Male, æt. 23, had chronic otorrhœa when a child. One year before his death was stabbed behind the right ear. The mastoid bone became necrosed, and for a year there was a discharge of pus from the mastoid cells. Dead bone was removed and pus evacuated two weeks before his death. There were no brain symptoms, pain at the point of injury being his only complaint. A few days after the operation he suddenly died.

Autopsy.—The anterior surface of the right petrous bone was necrosed, and the dura above it inflamed. In the right middle lobe of the cerebrum corresponding to the inflamed dura was an abscess containing pus, its cavity being lined with membrane. The third ventricle contained pus. (E. Krackowizer, *Trans. N. Y. Path. Soc.*, vol. i. p. 10.)

CASE XXVII. Abscess of the Temporo-sphenoidal Lobe.—Male, æt. 19, had suffered from chronic otorrhœa from the left ear for several years, which had been associated with considerable deafness. The discharge suddenly ceased, patient began to suffer from headache, nausea, and vomiting; quick pulse, and fever. These symptoms continued for ten days, during which time there was no disturbance of intellect, of vision, taste, or smell, and no paralysis. On attempting to get out of bed he suddenly became comatose and died.

Autopsy.—Caries of the petrous portion of the left temporal bone was found, and above it an abscess in the temporal lobe of the cerebrum near the base, containing $2\frac{1}{2}$ ounces of pus, which had involved a large portion of the temporal lobe and had burst into the left lateral ventricle. (A. Nebinger, *Med. Record*, vol. i. p. 61.)

CASE XXVIII. Abscess of the Temporo-sphenoidal Lobe.—Male, æt. 35, suffered from violent facial neuralgia of the left side with protrusion of the left eyeball and ptosis of the left upper lid for six months before his death. None of his special senses were impaired, and he had no paralysis. He died comatose.

Autopsy.—Caries of the left great wing of the sphenoidal bone, with adhesion of the dura to the brain above this point was found. An abscess had formed in the left temporo-sphenoidal lobe in its inferior convolution, and had burst into the lateral ventricle. (Harlan, *Med. Record*, vol. xix. p. 304.)

Of the many cases on record in the journals of otology, these are the only ones in which the abscess was not accompanied by an extensive general meningitis. They are chiefly of a negative value, as are also the following cases of tumour of the temporo-sphenoidal region.

CASE XXIX. Sarcoma of the Temporo-sphenoidal Lobe.—Female was brought into Bellevue Hospital in a condition of alcoholism, with a scalp wound. She was stupid, answered questions in monosyllables, and had no apparent paralysis. She died in four days.

Autopsy.—A tumour of the size of an egg was found in the left middle fossa of the skull, pressing upon the apex of the temporo-sphenoidal lobe and on the left optic nerve. It was a spindle-celled sarcoma. (E. G. Janeway, *Trans. N. Y. Acad. of Med.*, iii. p. 187.)

CASE XXX. Sarcoma of the Temporo-sphenoidal Lobe.—Male, æt. 29. Patient suffered for three years and a half from headache, vertigo, and attacks of falling, without loss of consciousness or convulsions. He had no paralysis.

Blindness gradually developed as a result of choked disks. Condition of sensation and of the other senses is not mentioned.

Autopsy.—A cystic tumour (a sarcoma) was found in the left temporal fossa, compressing the anterior and inferior surface of the left temporo-sphenoidal lobe of the brain. (J. C. Shaw, *Trans. Amer. Neuro. Assoc.*, 1877. Report in *Journ. Ment. and Nerv. Dis.*, July, 1877.)

CASE XXXI. *Sarcoma of the Temporo-sphenoidal Lobe.*—Female, æt. 39, began to have attacks of grand mal and of petit mal seven weeks before her death, and within two weeks of their commencement her mind became affected, she became drowsy and stupid, and went into a condition of dementia, so that on admission to the N. Y. Hospital she lay in a state of semi-consciousness all the time. She could be aroused, and understood enough to protrude her tongue when told to do so, but gave no other sign of consciousness. She once attempted to get out of bed. No ocular symptoms, no facial or other spasms, and no paralysis were noticed. Percussion on the left side of her head was painful. She died ten days after admission from exhaustion.

Autopsy.—The convolutions of the left hemisphere were flattened. A tumour was found at the base of the temporo-sphenoidal lobe on the left side, its under surface flattened and resting partly upon the left lobe of the cerebellum. The pia mater was normal. The tumour occupied the posterior part of the fourth and fifth temporal convolutions, and the third convolution was atrophied. The antero-posterior diameter was 2 inches; its transverse diameter was $1\frac{1}{2}$ inch; its vertical diameter was $1\frac{1}{4}$ inch. A layer of normal brain tissue, $\frac{1}{2}$ inch thick, separated it from the lateral ventricle, whose ependyma was normal. The tumour was a sarcoma. (*N. Y. Hospital Histories*, N. S., vol. x. p. 445. Dr. W. H. Draper.)

CASE XXXII. *Gumma of the Temporal Convolutions.*—Male, æt. 33; syphilitic. After a blow on the head, he suffered from continuous dull headache, which was occasionally severe; from vomiting and constipation; from impairment of sight, and of hearing in the right ear; from partial anæsthesia of the right side, and from hyperæsthesia of the left side. He was stupid and drowsy, and seemed to lack energy. General convulsions occurred a few hours before death.

Autopsy.—A gumma $1\frac{1}{4}$ inch in diameter, adherent to the dura and pia, was found involving the first and second temporal convolutions of the left hemisphere. A layer of brain substance, both anterior and posterior to the tumour, was softened. An abscess was found on the inner side of the tumour which had destroyed much of the white matter of the temporal lobe. (C. K. Mills, *Arch. of Med.*, August, 1882.)

CASE XXXIII. *Foreign Body in the Temporal Lobe.*—Male, æt. 20, had a cylindrical piece of iron, 1 inch long and $\frac{3}{4}$ inch in diameter, driven into the left side of his head by the explosion of a gun. He was stunned, but soon recovered, and complained only of headache, defect of hearing in his left ear, and soreness in the wound. An attempt to remove the foreign body failed. The patient went back to his work, and for four and a half months presented no brain symptoms whatever, except the deafness. The fistula remained and discharged pus. At the end of this time he went on a spree, and the next day was seized with violent headache, and died in three hours.

Autopsy.—"The iron was found in the anterior and inferior angle of the left middle lobe of the cerebrum, in near proximity to the fissure of Sylvius. The cavity in which it was embedded was lined by a membranous cyst." (Geo. Burr, *Amer. Journ. Med. Sci.*, July, 1882, p. 59.)

It is difficult to determine in the last two cases whether the symptom of deafness is to be associated with disease of the temporal convolutions, or is to be ascribed to a direct lesion of the auditory nerve. The latter is probable in the second case, both from the direction of the wound and from the fact that the deafness was on the side of the lesion. In the few foreign cases in which deafness accompanied a lesion of the temporal

lobe, as in Case XXXII., the ear opposite to the lesion was the one affected. This accords with the results of physiological experiment, which locate the perception of auditory sensations in the first temporal convolution of the opposite side. In a case to be cited later (Case L.) the first temporal convolutions on both sides were atrophied, and the patient was totally deaf. It is well known that sensory aphasia has been associated with lesions of the first temporal convolution. The loss of the memory of sounds, and the consequent failure to recognize words when spoken, as well as the inability to speak, which is due to the impossibility of remembering how the words sound which one desires to use, is a form of aphasia which is characteristic of disease in this region of the brain. The American records contain several well studied cases of this kind, in all of which the first temporal convolution was involved. Unfortunately, however, in none of the cases was this convolution involved *alone*. In six cases the central region was also affected, and paralysis was associated with the aphasia. These will be considered later. In the following case the supramarginal convolution was affected as well as the temporal; but as the prominent and permanent symptom was the aphasia this case is cited here. The report of the case is as thorough and accurate as any in medical literature, and suffers much in the attempt at condensation. Only its chief features, however, can be mentioned.

CASE XXXIV. *Amnesic Aphasia*.—Male, æt. 52, was suddenly seized with aphasia and incomplete right hemiplegia with anæsthesia, and pain in the left frontal region, there being no loss of consciousness at the time. After six weeks the paralysis had almost entirely disappeared, but the aphasia remained. It was amnesic aphasia, or word deafness, many words being unrecognized, and these being the ones he could not pronounce. The concepts could be recalled, but their symbols in words were gone. He could read aloud, but would often substitute other words for those seen, being at the time aware of the fact. Gesture language was understood and used. There was at first agraphia, but he learned to write. Hearing and sight were unimpaired, and memory, except for words and sounds, was good. Spacial relations were understood, but he had a tendency to hold objects, *e. g.*, cane, pen, knife, etc., by the wrong end, and would correct himself, angrily. Paræsthesia, without anæsthesia, occurred constantly in the regions supplied by the ulnar nerve, and by the musculo-cutaneous nerve of the leg on the right side. One year after the first attack a second one occurred, accompanied by hallucinations of sound on his right side, and slight paresis and anæsthesia of the left side, all of which symptoms soon disappeared entirely. Two months after this a final attack occurred, with vertigo, rotatory movements to the right, mental confusion, sudden blindness, which passed away in two hours, gradual failure, and in six weeks death. The aphasia was the chief and permanent symptom.

Autopsy.—The left hemisphere was the seat of a large depression, caused by the destruction of several convolutions, viz., the whole of the inferior parietal lobule, with the first two temporal gyri. The posterior central convolution was preserved intact, as was also the posterior extremity of the angular gyrus. The lesion was a yellow patch of softening lying in the region supplied by the posterior terminal branches of the left middle cerebral artery. The softening destroyed the cortex and the white substance beneath it, as far down as the roof of the lateral ventricle. (A. B. Ball, *Arch. of Med.*, April, 1881.)

From the review of these cases the following facts appear: Lesions of the temporo-sphenoidal lobes may exist without giving rise to any local

symptoms. Symptoms of disturbance of the special senses of hearing and smell, and loss of memory of perceptions acquired through these senses, may be caused by lesions of this region; odours being probably perceived in the inner sphenoidal convolutions, and sounds in the first temporal convolutions. The areas connected with motion, with general sensation, and with vision, do not lie in the temporal lobes.

The importance of a careful examination of all the special senses in any case of suspected brain-disease is enforced by the probability that some of the sensory areas lie in this region; but that the symptoms produced by their destruction have been hitherto overlooked. The conclusions here stated are in full accord with those of foreign observers.

III. OCCIPITAL LOBES.

Lesions of this region of the brain are not frequent, and but eleven cases have been found in which the basal ganglia were not involved with the cortical substance.

CASE XXXV. *Bullet in the Occipital Region.*—A girl, æt. 7 years, who had been shot in the head, walked into the office without any brain symptoms. A probe passed in four inches, but did not strike the ball. She died six months afterward from scarlet fever, never having presented any cerebral symptoms.

Autopsy.—The ball had entered the posterior lobe of the right hemisphere near its junction with the middle lobe, passed through it, across the longitudinal fissure, and had entered the left posterior lobe, where it was found embedded in the substance of the brain, near the surface. (J. C. Hutchinson, *Buffalo Med. and Surg. Journal*, vol. v. p. 223.)

CASE XXXVI. *Softening of the Occipital Lobes.*—Male. , When five years old was an intelligent child. At that time he began to see dimly, and at last became entirely blind. He then began to show an inability to fix his attention, and at length, within six years, became completely idiotic. One year before his death, which occurred at the age of thirteen, he was attacked with epileptic convulsions, which became more frequent until they destroyed his life. Paralysis of the left side and violent convulsions of the right side preceded his dissolution. During his idiocy he retained the power of singing, could learn new songs, and sang several songs well a few days before death, though he evidently attached no meaning to the words. All mental effort was impossible.

Autopsy.—Adhesions existed along the longitudinal sinus, gluing the membranes together. These were recent. There was an excess of serum in the cranium, and the brain was small and shrunken. "Below the middle line of the brain, and principally in the middle and posterior lobes, were many spots where the surface was flattened. On cutting into these, the knife passed through a layer of gray cerebral matter which adhered to the membranes, and then entered a cavity whose walls were ill defined. This cavity was bounded on all sides by gray matter, and followed the curves of the convolutions." The process was considered a chronic peripheral encephalitis. (S. W. Mitchell, *Proceedings Path. Soc. Philadelphia*, vol. i. p. 37, 1858.)

CASE XXXVII. *Softening in the Occipital Lobe.*—Male, æt. 63, was suddenly seized with loss of power and sensation in the right side, and a disturbance of sight. The paralysis was not associated with aphasia, and passed off in the course of a month. The visual disturbance and the partial anæsthesia remained. No absolute defect in the visual field was found, but the patient had become colour-blind to green and was diplopic. The visual disturbance consisted of a subjective blurring of all objects seen. "Everything," he said, "appeared dull and hazy." Several months after a tremor developed in the formerly paretic limbs, and right facial paresis appeared again. He became emotional, slow in answering questions, and died six months after the first attack.

Autopsy.—Thrombotic softening involving the median surface of the left occipital lobe, including the cortex bordering the calcarine fissure, the upper edge of the lingual gyrus, the lower half of the cuneus, and the included white substance. The softening reached to within half an inch of the posterior cornu of the lateral ventricle. (N. E. Brill, *Amer. Journ. of Neurology*, vol. i. p. 356.)

CASE XXXVIII. *Abscess of the Occipital Lobe.*—Male, æt. 13, had typhoid fever in May, and in June suffered from headache and dimness of vision in the left eye, which persisted. In July, after a blow on the head, an abscess formed in the scalp in the occipital region, which was opened in September. During August he had daily attacks of general tremor, commencing with pain in the neck and mental excitement, and occasional attacks of vomiting. He died suddenly in September.

Autopsy.—Abscess of the scalp was found, and beneath it the occipital bone was necrosed. Under the necrosed bone there was a meningitis, with adhesion of the membranes to the brain. In the very posterior part of the left hemisphere of the brain was an abscess containing four ounces of yellow pus. It was lined by a membrane, and the white brain substance around was softened to a depth of half an inch. The softening extended two inches anteriorly to the abscess into the white matter. The right lateral ventricle was large and full of serum; the left was smaller. (J. B. S. Jackson, *Boston Med. and Surg. Journ.*, vol. lxii. p. 356.)

CASE XXXIX. *Abscess of the Occipital Lobe.*—Male, æt. 35, was wounded by a bullet in the occipital region, August 19th. He fell, with a momentary loss of eyesight and faintness, but did not lose consciousness, and in a few moments got up and walked away. During the next three weeks he travelled to his home, was able to be up and about attending to business, and complained only of heaviness in the head and disturbance of eyesight. Sept. 7th, he had a chill, a pain in the occiput, and soon became delirious. On the 14th he became comatose, and died.

Autopsy.—A fracture was found in the occipital bone; a limited area of meningitis beneath it; and under the pia a small abscess containing two ounces of pus was found in the brain, involving the posterior lobe of the right side. (Warren, *Boston Surg. and Med. Journ.*, vol. lxxii. p. 100.)

CASE XL. *Tumour in the Occipital Lobe.*—Male, æt. 23, was struck in the head in 1864, but had no symptoms until March, 1868, when headache, very severe in the right posterior part of the head, and dimness of vision, with some unsteadiness of gait, and digestive disturbance, developed gradually. His mind was not affected, but he suffered so much that he became apathetic, and lay in bed indifferent to his surroundings. Nine months after the onset of the headache he began to be very restless, would walk constantly and talk to himself; his intellect and memory began to fail; he no longer recognized friends; and spasms in the muscles of all the limbs commenced and became frequent. There was no paralysis except of the external rectus of the left eye; but his gait was unsteady up to the day of his death. He died in a convulsion, January 16, 1869.

Autopsy.—At a point over the posterior lobe of the right hemisphere the membranes were adherent to the brain, the vessels congested, and a cheesy-looking tumour of irregular shape dipped into the brain tissue to a depth of one inch. The outer part of the tumour was soft and easily broken, leaving a granular mass; the inner part was firm. The brain around it was softened, and the convolutions were obliterated. There was little fluid in the right lateral ventricle as its walls were in close contact. (J. D. Lomax, *Medical and Surgical Reporter*, vol. xxi. p. 93.)

CASE XLI. *Fibroma in the Occipital Lobe.*—Male, æt. 23, was kicked on the head, and suffered afterward from continuous headache with exacerbations, from vomiting, vertigo, and mental confusion, at times amounting to mania. He developed left convergent strabismus, partial right hemianæsthesia with increase of the deep reflexes on the right side. He became blind, first in the right and then in the left eye; choked disks were present. Hearing became defective in the right ear. The temperature over the right parietal region was 0.2° F. above that on the left side.

Autopsy.—A fibroma $2\frac{1}{2}$ inches in diameter adherent to the membranes was found involving the left occipital and posterior parietal regions to within $\frac{1}{2}$ inch of the longitudinal fissure. The brain beneath and around the growth was softened and broken down. The occipital and posterior parietal lobes were almost entirely destroyed, especially in the white matter. (C. K. Mills, *Arch. of Med.*, August, 1882.)

CASE XLII. *Carcinoma of the Temporo-occipital Region.*—Male, æt. 13. A tumour gradually grew upon the cranium to the left of the vertex for four months, and was attended with headache, general muscular pains, and some dimness of vision, which increased to total blindness with exophthalmos. The symptoms increased steadily up to death, but the patient's mind was not impaired, nor was there any paralysis or disturbance of sensation.

Autopsy.—In addition to the tumour of the scalp (a carcinoma) the occipital bone was found to be softened and a second tumour or series of small tumours was found on its inner surface in the substance of the dura. These tumours were not adherent to the brain, but had compressed it so that the convolutions were destroyed by atrophy from pressure. The convolutions involved were the middle and posterior part of the three temporal, the angular gyrus, the posterior parts of the inferior and superior parietal lobules, and the first and second occipital convolutions on the left side. The tumours were soft carcinomata. (M. M. Bagg, *Journal of Insanity*, vol. xxxvii. p. 392.)

CASE XLIII. *Carcinoma of the Occipital Lobe.*—Male, æt. 42. During September, 1880, the patient suffered from continued headache, vertigo, vomiting, and loss of memory. He was admitted to the hospital and examined carefully, but no signs of paralysis, anæsthesia, or loss of special senses (except deafness of long standing) were discovered. In November his mental powers failed rapidly, his speech became incoherent, and his memory very faulty. He died of cancer of the liver November 10th.

Autopsy.—The inferior central portion of the posterior lobe of the left side was compressed by an ovoid tumour attached to the membranes, $1\frac{1}{2}$ inches in diameter and 1 inch thick. The central portions of the occipito-temporal convolutions were softened. The hippocampus was touched, but not altered to any extent. The softening had progressed so far as to open the lateral ventricle, the destruction not involving any of the central ganglia, or the crus cerebri. Microscopic examination showed the tumour to be a cylindrical epithelioma. The membranes of the brain were thickened everywhere and the fissures adherent. One corner of the tumour had produced a small superficial spot of softening in the cerebellum. (H. F. Formad, *Phil. Med. Times*, vol. xi. 274.)

CASE XLIV. *Sarcoma compressing the Occipital Lobes.*—Male, 56; suffered for $1\frac{1}{2}$ years from a tumour of the occiput which gradually increased in size, but gave rise to no brain symptoms. An attempt to remove this failed as it was found to have penetrated and eroded the skull. After the operation the patient remained in the same condition for four weeks, then lost the power of motion and sensation on the right side for a week, but recovered them, and finally six weeks after the operation developed a left hemiplegia and died in three days.

Autopsy.—Sarcoma of the dura mater had eroded the skull for an area of two square inches. The tumour arose from the falx cerebri, and had extended between the hemispheres to a depth of $1\frac{1}{2}$ inches, flattening the convolutions on either side in the occipital region. On incision an abscess the size of a pigeon's egg was found in the "left posterior central convolutions."¹ (E. N. Brush, *Amer. Journ. of Insanity*, vol. xxxvi. p. 342.)

CASE XLV. *Glioma of the Occipital Lobe*—Female, æt. 34, began to suffer from very severe headache recurring in paroxysms every day or two in January, the first attack being accompanied by nausea and disturbance of vision, the latter symptom lasting two days. These symptoms continued during February, the pain at times being agonizing. On March 3, it was noticed that the right pupil was dilated, and ptosis with paresis of the muscles of the eyeball developed soon after. On the 6th choked disk was found. From this time she became stupid, swallowing became difficult, and she suffered from pain in the neck and shoulders.

¹ The median surface of the occipital lobe is probably intended.

The average surface temperature of the head was 6.4° Fahr. above normal, being highest over the right occipital region where it was 100.5° Fahr. On the 16th she became comatose and died.

Autopsy.—Meninges normal. The whole right occipital lobe was elastic and fluctuating, and while being examined gave way, and an ounce of softened brain substance and a colloid material exuded. A soft colloid tumour of the size of a hazel-nut was found between the horizontal or posterior branch of the fissure of Sylvius and the first temporal fissure. The whole right occipital lobe was softened and disintegrated, and the tumour projected into its substance. The line of demarcation between the tumour and the brain was marked by the tortuous vessels supplying the growth. It was a glioma. (F. W. Rockwell, *Trans. N. Y. State Med. Soc.*, 1879, p. 114.)

The most prominent local symptom of lesion of the occipital lobes is a disturbance of vision. This was present in eight of the cases here cited. In two of these cases the lesion was a tumour, and choked disks were discovered on examination, but in the cases of softening and of abscess no such explanation can be offered for the symptom. From a study of twenty-seven cases of lesion of the occipital region collected from foreign sources, it has been shown¹ that lesions of one occipital lobe produce blindness of the like-named halves of both retinae. In the cases here collected no determination of the visual field was made, the examination having been incomplete. The exact defect of vision in the foreign cases was not noticed by the patients, the chief complaint in all cases being of a disturbance of sight in but one eye. This was also the complaint in two of these cases, and as the visual field was not measured it is impossible to determine whether the symptom was unilateral or bilateral. Greater care in the examination of the special senses is necessary. But although no statement can be made as to the exact disturbance of vision, the American cases indicate a connection between the lesions of the occipital lobe and blindness, and thus do not oppose the conclusions drawn from a study of foreign cases.

An absence of motor or sensory disturbance, except the affection of vision, is to be noted in cases of occipital lobe lesion. In but two cases was paralysis present, and in one of these cases it cannot be referred to the occipital lesion, since this was a tumour of slow growth, while the hemiplegia developed but three days before death, while in the other case it was only a temporary symptom. Certain anatomists have traced a portion of the tracts supposed to convey general sensory impulses to the occipital region. The absence of symptoms of general anæsthesia in the large majority of both foreign and American cases of lesion of the occipital lobes throws doubt upon this conclusion. As yet there are too few pathological facts to demonstrate the localization of the areas of general sensation in the occipital region. The mental symptoms which presented themselves in three of the cases differed from those which were produced by frontal lesions. They consisted in loss of memory and occasional onsets of maniacal excitement. In one case it is stated that the patient failed to recognize his friends.

¹ The Visual Area of the Brain, M. A. Starr, *Amer. Journ. Med. Sci.*, Jan. 1884.

These cases warrant the conclusions that the visual area lies in the occipital lobes, and that the areas governing speech, motion, general sensation, and non-visual sensory impressions lie elsewhere.

Foreign observers have noticed, in many cases of affection of the occipital region, a loss of memory of objects recognized by sight while auditory or motor memories were not affected.¹ These facts have led to the hypothesis that various kinds of memories are located in various regions, the memories of objects perceived by the different senses being stored up in the portions of the brain in which those sense perceptions were originally received. It has been already shown that lesions of the temporal region in which auditory impressions are received may give rise to sensory aphasia or loss of memory of the sound of words. Cases of loss of memory of the appearance of words, and consequent inability to read and write, while all the other mental faculties were preserved, are on record, and in the three cases in which an autopsy was made a lesion of the angular gyrus which lies at the junction of the occipital, temporal, and parietal regions was found.² In the following case this symptom was present for a time, but passed away, and the original occurrence of the aphasia and agraphia, as well as its disappearance, is referred to a temporary pressure on this region by a hemorrhagic clot which was afterward absorbed. The case is also of value as an illustration of a form of aphasia which is neither purely motor nor purely sensory, but has been described by Kussmaul as paraphasia, and by Wernicke as aphasia of incoördination,³ and which consists in the tendency on the part of the patient to substitute irrelevant words for those which he wishes to say.

CASE XLVI. Paraphasia. Agraphia.—Male, was suddenly attacked with inability to make himself understood. He could articulate perfectly, could put words together, and could understand what was said to him, but when he tried to talk, wrong words were substituted for those which he desired to use, and words were not used in their right relations. He noticed at the same time some loss of memory of words, *e. g.*, the first person plural of a Greek verb. There was also an inability to write a sentence correctly, as he substituted a wrong word for the one dictated, and wrote wrong letters in a word. On one occasion he had an hallucination of vision which he perceived as such. He had no paralysis. Sensation was not tested. He gradually recovered, and three months after the attack was perfectly well. He was eccentric and excitable, and not long after his recovery committed suicide.

Autopsy.—Pia mater thickened, but not adherent to the brain, except at one or two spots in the temporal region. Numerous miliary aneurisms on the small arteries, and vacuoles in the brain substance were found. In the left hemisphere, at the posterior extremity of the Sylvian fissure in the supra-marginal convolution, a cavity, three-quarters of an inch in diameter, filled with dark serum, and a meshwork of fibrous tissue, was discovered. This extended into

¹ Fürstner, Arch. f. Psych., viii. ix. Reichart, Arch. f. Psych., ix. Stenger, Arch. f. Psych., xiv.

² Déjevine, Arch. de Neurol., No. 6; Chauffard, Rev. de Méd., Nov. 1881; Magnan, Gaz. Méd. de Paris, Dec. 1879.

³ Leitungsaphasie, Lehrbuch d. Gehirnk., vol. I. p. 205.

the white substance toward the lateral ventricle. A small, old hemorrhagic focus was also found in the right lenticular nucleus. (S.G. Webber, *Boston Med. and Surg. Journ.*, cix. p. 581.)

IV. PARIETAL LOBULES.

Few cases of lesion limited strictly to the parietal lobules are recorded. Those that were found in American journals are chiefly of negative value, and indicate that the posterior limit of the motor area does not extend beyond the posterior central convolution. No definite function has been assigned to this region of the brain, and the symptoms which have occurred in the majority of foreign cases, like those which have been described in the four cases of lesion of the supra-marginal convolution already given,¹ have been ascribed rather to the destruction of convolutions connecting these lobules with the temporal or occipital regions. When a lesion of this region involves the posterior central convolution, motor disturbances occur. In a few cases slight disturbances of sensation have followed lesions of these lobules. They may have been due to an extension of the disease to the central convolutions. No cases are found to confirm the statement of Landouzy, that a motor area governing the movements of the eyes and muscles of the lids lies in the inferior parietal region. The following cases are cited without further comment.

CASE XLVII. Abscess in Parietal Region.—Male, æt. 12, fell upon a nail, which was driven into the right parietal bone, a little posterior to the protuberance, penetrating the brain $1\frac{1}{4}$ inch. He walked home, and for three weeks suffered from general symptoms of encephalitis without local symptoms. He then recovered, and for three months was in perfect health, both mental and physical condition being good. He then was suddenly seized with frontal headache, and died in three days.

Autopsy (33 hours p. m.).—The middle and posterior lobes of the right hemisphere were softened to a consistence of cream and nearly diffuent. At a depth of $1\frac{1}{2}$ inch beneath the old wound of the skull, an abscess, containing 4 ounces of pus, was found in the brain. The abscess was not limited by a membranous wall, but its sides were made up of denser brain substance. (Downs, *Amer. Journ. of Med. Sci.*, Oct. 1871.)

CASE XLVIII. Abscess in Parietal Region.—Male, æt. 25, was kicked by a horse, and had a depressed fracture of the right parietal bone on July 3d, after which he suffered from symptoms of meningitis without local paralysis, from which he recovered, and on the 29th went to work. During August he had much headache on the right side, and felt weak. September 30th came back to hospital on account of the pain in his head, and on October 4th was trephined with result of relieving the pain. October 21st, after an attack of tonic spasm of the left arm, without motor or sensory paralysis, he became comatose and died.

Autopsy.—An abscess, $1\frac{1}{2}$ by 1 inch in diameter, was found in the right posterior central and inferior parietal convolutions, near the gypsus supra-marginalis, enclosed in a firm capsule. The brain around it was softened, but the cortex was not involved. (J. S. Wight, *Medical Gazette*, ix. p. 558.)

CASE XLIX. Tumour Compressing Parietal Regions.—Male, æt. 45, fifteen years before the appearance of symptoms, had been kicked on the head by a horse. Fifteen months before death a small hard tumour of the scalp in the central line just posterior to the vertex appeared and increased in size. During the following year he suffered from very severe headaches, and gradually lost the sight of the right eye. He applied for treatment on account of the tumour, which

¹ Cases XX., XXXIV., XLI., XLVI.

had grown to be $3\frac{1}{2}$ inches in diameter at its base, and on account of the headache, and disturbance of vision which was affecting the left eye as well as the right. There were no other brain symptoms. No ophthalmoscopic examination was made. The tumour, an ivory exostosis, was removed, and the patient recovered from the anæsthetic, and was conscious. The next day he had a convulsion, and thirty-seven hours after the operation he died, having been rational until the end.

Autopsy.—The dura was thickened at a point opposite the situation of the external tumour in the middle line. On cutting through the dura a tumour was found situated in the great longitudinal fissure between the hemispheres, attached to the falx cerebri, and obliterating the longitudinal sinus for a distance of $3\frac{1}{2}$ inches in its third quarter from the front. The tumour was firm, yellow, $3\frac{1}{2}$ by 3 inches in size, and had compressed without destroying the adjacent brain tissue to which it was not adherent, and which was everywhere healthy. Microscopical examination showed it to be a carcinoma. (C. E. Isaacs, *Trans. N. Y. State Med. Soc.*, 1859, p. 82.)

The superior parietal lobules posterior to the paracentral lobules must have been compressed.

CASE L. Atrophy of the Parietal and Temporal Regions.—Female, æt. 34; in July, 1879, she lost power in her right arm and hand, and soon after had an attack characterized by sudden loss of consciousness, which lasted two weeks (?), after which she was found to be paralyzed on the right side, deaf, and to be insane, talking incoherently, and having hallucinations of sight and hearing. There were no convulsions. The paralysis gradually passed off, but she became blind and deaf. On admission to the asylum, Sept. 1879, the patient was found to be very stupid, quite blind and deaf, and in poor physical condition. She gropes about, talks disconnectedly, screams, and is dirty. During October, she had an epileptic convulsion, beginning in the right side, and in November a second more marked in the left side of the face. There was at this time paresis of the right hand. Tactile sensibility was preserved. In January, 1880, she had a severe convulsion, followed by contracture of the right arm, which lasted seven days and then disappeared, leaving no signs of paresis anywhere. She remained in the same condition, becoming more noisy and stupid, until September, 1881, when she died of pneumonia.

Autopsy.—Slight meningitis everywhere. Remarkable atrophy of the superior and inferior parietal convolutions on both hemispheres. The upper part of the posterior central on the left side, and the lower part of the posterior central on the right side were also slightly atrophied, but this atrophy was limited to a very small area. The first temporal convolutions on both sides were atrophied to one quarter their normal breadth. "Microscopic examination showed that in these regions the gray cortical matter had entirely disappeared, leaving its outer layer attached to the pia mater, and lying next to the white substance, which was found to contain nuclei of all sizes." The perivascular spaces were dilated and filled with nuclei. Optic nerves were atrophied. (J. C. Shaw, *Arch. of Medicine*, Feb. 1882.)

While certain direct local symptoms of disease in the frontal, temporal, occipital, and parietal regions of the brain have been found by a study of these fifty cases, the important fact is also presented that the areas governing motion and general sensation must lie in other parts. The method of exclusion indicates that these areas are to be found in the central convolutions. But positive facts are not wanting to support this conclusion. We shall, therefore, in a future paper consider the lesions of the motor area.